T03D07 – SL Periodicity Exam MS

1. C **(6)**
2. A **(5)**
3. B **(5)**
4. B **(3)**
5. C **(5)**
6. C **(4)**
7. B **(5)**
8. A **(6)**
9. A **(6)**
10. D **(4)**
11. C **(4)**
12. D **(7)**
13. C **(5)**
14. D **(4)**
15. A **(4)**
16. C **(5)**
17. B **(3)**
18. D **(5)**

IB Chem SL1		Free Response Section (Paper 02)													
Level:	Needed	Grade	Possible	3		4		5		6		7		Cutoff	
Above +6	0%	2	0	55%	1.7	45%	3.15	35%	8.4	20%	1.2	10%	0.7	15	
Above +5	10%	3	3	80%	2.4	55%	3.85	45%	10.8	35%	2.1	20%	1.4	21	
Above +4	20%	4	7	90%	2.7	80%	5.6	55%	13.2	45%	2.7	35%	2.5	27	BELOW
Above +3	35%	5	24	95%	2.9	90%	6.3	80%	19.2	55%	3.3	45%	3.2	35	STANDARD
Above +2	45%	6	6	100%	3	95%	6.65	90%	21.6	80%	4.8	55%	3.9	40	ABOVE
Above +1	55%	7	7	100%	3	100%	7	95%	22.8	90%	5.4	80%	5.6	44	
Level	80%	Multiple Choice Section (Paper 01)													
Below -1	90%	Grade	Possible	3		4		5		6		7		Cutoff	
Below -2	95%	2	0	55%	1.1	45%	2.25	35%	2.45	20%	0.6	10%	0.1	7	
Below -3	100%	3	2	80%	1.6	55%	2.75	45%	3.15	35%	1.1	20%	0.2	9	
Below -4	100%	4	5	90%	1.8	80%	4	55%	3.85	45%	1.4	35%	0.4	11	BELOW
Below -5	100%	5	7	95%	1.9	90%	4.5	80%	5.6	55%	1.7	45%	0.5	14	STANDARD
Below -6	100%	6	3	100%	2	95%	4.75	90%	6.3	80%	2.4	55%	0.6	16	ABOVE
Below -7	100%	7	1	100%	2	100%	5	95%	6.65	90%	2.7	80%	0.8	17	

19. ***alkali metals:***
(5x1)metallic bonding/a bed of cations in a sea of electrons;
(6x1)as radius increases down the group, valence electrons are further away from nucleus (and strength of metallic bonding decreases);
halogens:
(5x1)non-polar/van der Waals' forces between molecules;
(6x1)as size increases van der Waals' forces increase (and melting point increases);
period 3 elements:
(6x1)increase in melting points of metals (Na, Mg, Al) due to increase in number of valence electrons **and** decrease in size/the way atoms are packed as solids;
Award mark just for "increased number of delocalized or valence electrons".
silicon:
(7x1)network covalent solid (with very high melting point);
Award mark also for "many or strong covalent bonds".
P → Ar:
(6x1)simple molecular (atomic in case of Ar) substances with weak van der Waals' forces (and lower melting points);
(7x1)trend in P_4, S_8, Cl_2, Ar due to size/mass of particles; 8
Award mark for "decreasing mass or size".
Molecular formulae not necessary.

[8]

20. (i) ***Li to Cs***
(4x1)atomic radius increases;
(5x1)because more full energy levels are <u>used</u> or <u>occupied</u>/<u>outer</u> electrons further from nucleus/outer electrons in a higher shell;
(4x1)ionization energy decreases;
(5x1)because the electron removed is further from the nucleus/increased repulsion by inner-shell electrons; 4
Accept <u>increased</u> shielding effect.

(ii) ***Na to Cl***
(4x1)atomic radius decreases;
(5x1)because nuclear charge increases **and** electrons are added to same main (outer) energy level;
(4x1)ionization energy increases;
(5x1)because nuclear charge increases **and** the electron removed is closer to the nucleus/is in the same energy level; 4
Accept "core charge" for "nuclear charge".
In (i) and (ii) explanation mark dependent on correct trend.

[8]

21. (a) (i) **(3x1)**the (minimum) energy required/needed for the removal of one electron;
(5x1)from a gaseous/isolated atom; 2

(ii) **(5x1)**$Al(g) \rightarrow Al^{+}(g) + e$; 1
Do not penalize the answer if (g) is after e.

(b) **(5x1)**greater nuclear charge/greater number of protons/atom radius g is smaller;
(6x1)stronger attraction (for electron); 2

(c) **(6x1)**$2Li + 2H_2O \rightarrow 2LiOH + H_2$;
Ignore state symbols.
effervescence/fizzing/bubbles/*OWTTE;*
lithium moves around/decrease in size of piece;
Accept dissolves or disappears.
heat produced; 3
(5x2)*Award* ***[1]*** *each for any two of last three observations.*

[8]

22. (a) (i) **(4x1)**the ability of an atom to attract a <u>bonding</u> pair of electrons;
(4x1)inert/do not react/do not attract electrons/stable electron configuration/full outer electron shell/do not form bonds; 2

(ii) **(3x1)**electronegativity increases (along period 3 from Na to Cl);
(5x1)number of protons increases/nuclear charge increase/core charge increase/size of atom decreases; 2
Do not accept "greater nuclear attraction".

(iii) **(7x1)**Cl_2 stronger oxidizing agent;
(5x1)Cl_2 has greater attraction for electrons/has a higher electron affinity; 2
Accept converse statements for Br_2.

(b) **(5x1)**MgO - basic oxide/alkali;
(7x1)$MgO + 2HCl \rightarrow MgCl_2 + H_2O$/$MgO + H_2O \rightarrow Mg(OH)_2$;
(5x1)Al_2O_3 - amphoteric oxide/acidic and basic oxide;
(7x1)$Al_2O_3 + 6HCl \rightarrow 2AlCl_3 + 3H_2O$;
(7x1)$Al_2O_3 + 2OH^- + 3H_2O \rightarrow 2Al(OH)_4^-$/$Al_2O_3 + 2OH^- \rightarrow 2AlO_2^- + H_2O$;
(5x1)P_4O_6 - acidic oxide;
(7x1)$P_4O_6 + 6H_2O \rightarrow 4H_3PO_3$; 7
All equations must be balanced.

[13]

23. **(5x5)**$n(Fe_2O_3) = 30\times10^3 \div 159.7 / n(Fe_2O_3) = 188$ mol;
$n(C) = 5.0\times10^3 \div 12.01 / n(C) = 416$ mol;
Fe_2O_3 is the limiting reagent or implicit in calculation;
$n(Fe) = 2\times n(Fe_2O_3) = 2\times188 = 376$ mol;
$m(Fe) = 376\times55.85 = 21$ kg;
Accept 2 sig. fig. or 3 sig. fig., otherwise use - 1(SF).
Correct final answers score ***[5]****.*
Allow ECF.

[5]

24. (a) **(3x1)**atom of same element/same number of protons but with different mass number/number of neutrons; 1

(b) protons 23
electrons 23
neutrons 27 2
(5x2)*Three correct* ***[2]****, two correct* ***[1]****.*

(c) **(5x1)** $^{51}_{23}\mathrm{V}$ /51 nearer to A_r value of 50.94; 1

(d) **(4x1)**carbon, 12/^{12}C; 1

[5]